Coarse Terrigenous Fraction at IODP Site 1308, North Atlantic: Evidence For Changing IRD Sources Through Last 300ky

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I. Abstract

Integrated Ocean Drilling Program (IODP) Expedition 303 obtained ocean floor sediment cores from the North Atlantic, including Site 1308 at 50N 24W. These cores contain coarse terrigenous material, known as Ice-Rafted Debris (IRD), which was deposited by melting icebergs that had carried continental rock fragments and traversed the North Atlantic before melting. The abundance and composition of this IRD have been used as a proxy to understand the locations and history of glaciation on landmasses that border the North Atlantic.

In this study, 78 samples were analyzed to produce an IRD record to ~288,000 years before present (ka), with an average spacing between samples of ~4 ky. IRD abundances within these samples vary from 0.1 to 12.23%. The IRD composition is dominated by a relatively constant content of unstained quartz (~55%). The second-most abundant IRD grain is volcanic glass, whose average abundance increases upsection. Iron-stained quartz is the third-most abundant grain type; its abundance reaches a maximum at ~88ka, with decreasing abundance in younger sediments.

Variations in the abundances of individual IRD grain types appear to define three stratigraphic intervals with distinctive IRD assemblages; these are:

~73-0 ka – 55% qtz, 30-40% volc. glass, 5% Fe-stained qtz.
~150-73 ka – 55% qtz, 30% volc. glass, ~10% Fe-stained qtz.
~288-150 ka – 55% qtz, 10% volc. glass, ~7% Fe-stained qtz, ~10% rock frags.

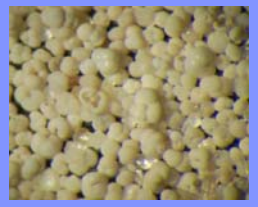
These compositional variations suggest that older IRD was supplied from a wider range of source regions, possibly indicating more geographically widespread glaciation.

II. Ice-Rafted Debris in the North Atlantic

- Coarse grained terrigenous rock fragments >150 µm
- Deposition requires glaciers reach sea level
- Amount released affected by glacial sediment load, nature of ice terminus
- Composition used to determine iceberg source region
- Dispersal affected by source location, thermal regime of glacier, sea ice coverage, and ocean currents
- Provides a more continuous record than on-shore or continental shelf

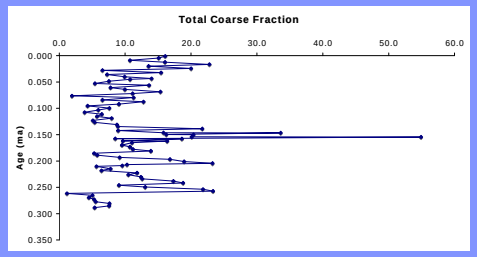
III. Materials And Methods

- IODP site 1308 - 18.46m of Holocene-Pleistocene silts and clays containing IRD.
- Sampling resolution ~4 ky
- Coarse sand fraction isolated through wet sieving to 150 µm and weighed
- Optically scanned, point counted, and separated into terrigenous, biogenic, and other.

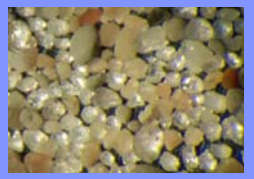


Coarse fraction of sample 1308E-1H-3, 128 cm, dominated by forams. Field of view ~9mm

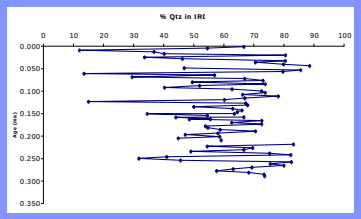
IV. Data/Results



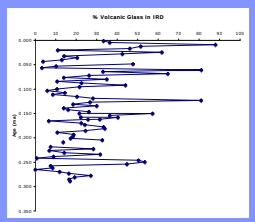
Total coarse fraction, showing a maximum at 154 ka.



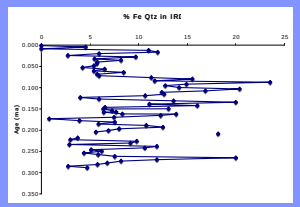
Coarse fraction of sample 1308C-2H-4, 128 cm, dominated by quartz. Field of view ~11mm



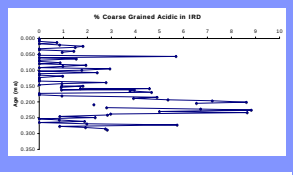
Quartz abundance within IRD. Note that average quartz content remains relatively uniform throughout section.

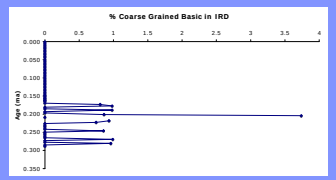


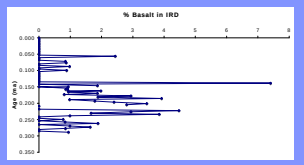
Volcanic glass abundance within IRD. Note that average volcanic glass content increases upsection.

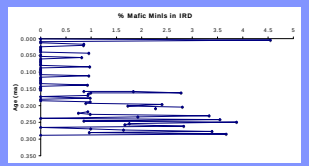


Fe-stained quartz abundance within IRD. Note that average Fe-quartz content increases up section to ~88 ka and is lower up the remaining section.

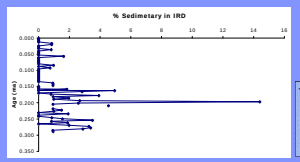


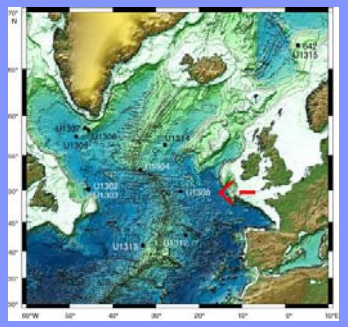






Abundances of other IRD grain types. Note the consistent pattern of relatively higher abundance in sediments older than ~150 ka.





V. Summary of IRD Compositional Assemblages

0 ka	
73 ka	~55% unstained qtz. 30-40% volc. glass 5% Fe-stained qtz.
150 ka	~55% unstained qtz. 30% volc. glass ~10% Fe-stained qtz.
288 ka	~55% unstained qtz. 10% volc. glass ~7% Fe-stained qtz. ~10% rock frags.

This table demonstrates the greater compositional variability in sediments older than 150ka, which suggests a wider range of IRD source regions. This may be an indication of more geographically widespread glaciation prior to 150 ka.

VI. Acknowledgements

I would like to thank Shell Oil Corp. for supporting this research, and for this opportunity for professional development.